Data User Guide

GPM Ground Validation Met One Rain Gauge Pairs IPHEx V2

Introduction

The GPM Ground Validation Met One Rain Gauge IPHEx V2 data were collected during the Integrated Precipitation and Hydrology Experiment (IPHEx) using Met One Model 380 tipping bucket precipitation gauges from October 2013 to October 2014 in the Southern Appalachians, spanning into the Piedmont and Coastal Plain regions of North Carolina. The campaign sought to characterize warm season orographic precipitation regimes and the relationship between precipitation regimes and hydrologic processes in regions of complex terrain. The data set contains two ASCII files per rain gauge with two rain gauges on a station platform. The gag dataset is quality-controlled reformatted precipitation recorded in millimeters at a temporal resolution of 1 minute and the gmin dataset contains cubic spline interpolated rain rates in millimeters per hour at 1 minute resolution.

Notice: Version 1 of this data set was produced by the PI and delivered to GHRC for access on the ftp server, but was never officially published. This version 2 is an updated data set with a different data file configuration.

Citation

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Keywords:

NASA; GHRC; NASA; IPHEx, GPM GV; North Carolina; rain gauges; tip bucket; Met One; Precipitation; precipitation amount; precipitation rate;

Campaign

The Global Precipitation Measurement (GPM) mission Ground Validation (GV) campaign used a variety of methods for validation of GPM satellite constellation measurements prior to and after launch of the GPM Core Satellite, which launched on February 27, 2014. The instrument validation effort included numerous GPM-specific and joint-agency/international external field campaigns, using state of the art cloud and precipitation observational infrastructure (polarimetric radars, profilers, rain gauges, and disdrometers). Surface rainfall was measured by very dense rain gauge and disdrometer networks at various field campaign sites. These field campaigns accounted for the majority of the effort and resources expended by Global Precipitation Measurement (GPM) mission Ground Validation (GV). More information about the GPM mission is available at http://pmm.nasa.gov/GPM.

One of the GPM-GV field campaigns was the GPM Integrated Precipitation and Hydrology Experiment (IPHEx) which was held in North Carolina during 2013 and 2014 with an intense study period from May 1 to June 15, 2014. The goal of IPHEx was to characterize warm season orographic precipitation regimes and the relationship between precipitation regimes and hydrologic processes in regions of complex terrain. The IPHEx campaign was part of the development, evaluation, and improvement of remote-sensing precipitation algorithms in support of the GPM mission through NASA GPM-GV field campaign (IPHEX_GVFC) and the evaluation of Quantitative Precipitation Estimation (QPE) products for hydrologic forecasting and water resource applications in the Upper Tennessee, Catawba-Santee, Yadkin-Pee Dee, and Savannah river basins (IPHEX-HAP, H4SE). NOAA Hydrometeorology Testbed (HTM) has synergy with this project. More information about IPHEx is available at http://gpm.nsstc.nasa.gov/iphex/
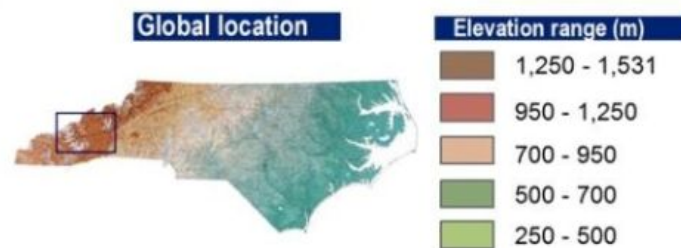

Figure 1: Region of North Carolina IPHEx campaign ground validation
(image source: http://gpm-gv.gsfc.nasa.gov/Gauge/)

Instrument Description

The Model 380 precipitation gauge, manufactured by Met One Instruments Inc., is a tipping bucket rain gauge which measures the amount of fallen precipitation (rain and/or snow). The gauge has a 30.5cm (12 inch) diameter catchment funnel that directs precipitation to a

tipping bucket assembly. When 0.254mm (.01 inch) of precipitation is collected, the tipping bucket assembly tips, draining the collection and activating a mercury switch for recording data. There are two gauges located on each platform as shown in Fig 2 below.

More detailed information on the Met One Model 380 Precipitation Gauge is available at http://www.metone.com/docs/370_380_precipitation_gauge.pdf

Fig 2: Dual tipping rain gauge bucket used for GPM-GV
(image source: http://gpm-gv.gsfc.nasa.gov/Gauge/)

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File Naming Convention
The GPM Ground Validation Met One Rain Gauge Pairs IPHEx data set consists of ASCII text (.txt) files. The files are named with the following convention:

iphex_raingauge_NASA00##_X_[YYYYMMDD_start]_[YYYYMMDD_end]_[gag|gmin].txt

Table 1: File naming convention variables

Variable	Description
NASA00##	Station platform number
X	Rain gauge letter (A or B) equipped on each platform
YYYYMMDD_start	YYYY = year, MM = month of year, DD = day of month
YYYYMMDD_end	YYYY = year, MM = month of year, DD = day of month
gmin	Cubic spline interpolated 1-hour rain rates (mm/h) at 1-min intervals calculated using the algorithm of Wang et al. 2008 (See References)
gag	Quality controlled reformatted rainfall data (mm) with a resolution of 1 second

The two file types contain measurements of fallen precipitation at recorded points in time and cubic spline interpolated rain rates during the study period 1-year extended observation period of IPHEx, October 2013 to October 2014.

Data Format Description

This data product contains text format data files organized by station and rain gauge. Two types of files exist for each gauge, one gag and one gmin. Each text file contains two header lines followed by the station data. The files contain non-zero rainfall data only and are therefore not a complete time series.

The first header line contains the data year, field program, gauge identification number, gauge type and bucket resolution. The second header line contains the column headers for each file type.
For GAG files:
year, month, day of the month, Julian day of the year, hour, minute, second, rain rate (mm), latitude and longitude.
For GMIN files:
year, month, day of the month, Julian day of the year, hour, minute, interpolated one-minute rain rate (in mm/hr), latitude and longitude.

Table 2: Data Characteristics

Characteristic	Description
Platform	GPM Ground Validation NASA Rain Gauge Pairs IPHEx campaign
Instrument	Met One Rain Gauge Pairs
Projection	n/a
Spatial Coverage	Each station is at a specific geographic location, collectively the data set covers 35.89 lat to 35.08 lat and -83.59 lon to-82.56 lon
Spatial Resolution	Point source

Temporal Coverage	Extended measurement program starts October 2013 and continues to October 2014. The intense operation period is May 1, 2014 to June 15, 2014. These data files cover the extended measurement time period. Each file contains data for that calendar year
Temporal Resolution	1 second
Sampling Frequency	1 second
Parameter	Precipitation, precipitation amount, precipitation rate
Version	2
Processing Level	2

Data Parameters

There are two rain values associated with this data product, each in separate files. The tipping bucket rain gauge rainfall values (mm) are in the gag files and the cubic-spline interpolated hourly rain rates (mm/hr) provided at a 1 minute intervals are in the gmin files. Each station platform has two gauges as shown in Fig. 2, which are referred to as gauge A or B. There is a separate set of files (gmin and gag) for each gauge.   The latitude and longitude of each rain gauge is provided in the file.

Algorithm

To create a quasi-continuous time series of 1-minute hourly rain rates, a cubic-spline algorithm is used to interpolate the measured gauge data. The algorithm used is described in Wang et al. 2008.

Quality Assessment

The rain gauges have a reported accuracy of ±0.5% at 13 mm/hr and ±1% at 25 - 75 mm/hr. Errors in tipping-bucket rain gauge measurement have been reported in Ciach, 2003, Tokay et al., 2010, Wang et al. 2008, Wang et al., 2010., and Wang et al, 2012.

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Contact Information

To order these data or for further information, please contact:

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